CORE
Metadata, citation and similar papers at core.ac.uk
Provided by Elsevier - Publisher Connector

2116-Pos Board B846
Antibody - Conjugated Superparamagnetic Iron Oxide Nanoparticles for Active Targeting of Adenosine Receptors
Zdenka Markova[1], **Marketa Havrdova**[1], Katerina Polakova[1], Jiri Tucek[1], Roman Kubinek[1], Aristides Bakandritsos[2], Evgenia Gerasimovskaya[3], Radu Moldovan[3], Petr Paucek[3,4], Radek Zboril[1].
[1]Regional Centre of Advanced Technologies and Materials (Departments of Experimental Physics and Physical Chemistry), Palacky University, Olomouc, Czech Republic, [2]Department of Materials Science University of Patras, Patra, Greece, [3]Anschutz Medical Campus University of Colorado at Denver, Denver, CO, USA, [4]Department of Integrative Physiology, Univeristy of Colorado at Boulder, Boulder, CO, USA.
Superparamagnetic iron oxide nanoparticles (SPIO) are regarded as advanced tools in biomedical science in disease diagnostics and therapies. We report the synthesis of antibody-conjugated nanoparticles (Ab-SPIO) that combine MRI behavior of nanoparticles with the selective and specific targeting of cellular proteins. Our novel Ab-SPIO will serve as a MRI biomarker for preventive PAH diseases. It is known that adenosine 1-type receptors (A1R) are involved in several cardiovascular diseases and offer promising therapeutic potential. In our study, we developed new A1R antibodies (Ab) conjugated SPIO nanocarriers as a specific Ab-MRI contrast agent. Spherical magnetite nanoparticles with a hydrodynamic diameter of 145 nm and particle size distribution of 15 - 60 nm were obtained. Surface of SPIO nanoparticles was stabilized by biocompatible polymer carboxymethyl cellulose (CMC) and precisely characterized in stability by measuring of zeta potential (- 43 mV). Strong magnetic response with a saturation magnetization of 75 Am^2/kg confirmed appropriate magnetic behavior for MRI application. Oriented immobilization of antibody (Adenosine A1-R Antibody (H-40)) on free carboxyl groups of CMC provides active targeting of adenosine receptors. We conducted microscopic evaluation of the Ab-SPIO probe in VVEC cells, localization (plasma membrane vs. intracellular), and we determined the effects of hypoxia on A1R expression, compared A1R expression in VVEC-Hyp vs. VVEC-Co, and determined the effects of acute hypoxia on A1R expression in VVEC-Hyp vs. VVEC-Co. The experiments are proposed for MRI imaging of VV in control and hypoxic animals.
Functionalized A1R-Ab-SPIO complexes will be utilized as a specific MRI biomarker in early disease diagnostics.

2117-Pos Board B847
Stochastic Gating and Molecular Transport in Carbon Nanotube Ion Channels
Jia Geng[1,2], Kyunghoon Kim[3], Ramya Tunuguntla[4], Caroline Ajo-Franklin[5], Aleksandr Noy[2,4].
[1]Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, CA, USA, [2]UC Merced, Merced, CA, USA, [3]UC Berkeley, Berkeley, CA, USA, [4]Lawrence Livermore National Laboratory, Livermore, CA, USA, [5]Lawrence Berkeley National Laboratory, Berkeley, CA, USA.
Living systems control transport of ions or small molecules across biological membranes using ion channels that form highly efficient and selective pores in lipid bilayers. Although bottom-up synthesis and top-down fabrication could produce pores of comparable size, an unresolved challenge remains to build nanopore scaffolds that fully replicate transport properties of membrane channels. We will show that pores in lipid membranes formed by ultrashort carbon nanotubes (CNTs) have transport properties that come remarkably close to that goal. These carbon nanotube channels can transport water, protons, small ions, and DNA and their ion-rejection properties can be controlled by the charge at the pore mouth. Interestingly, these pores also display the stochastic "gating" behavior common for biological ion channels. We attribute this effect to a spontaneous reversible ionic "penetration-exclusion" transition, suggesting that it represents a general feature of nanofluidic transport in sub-2-nm pores. Overall, transmembrane CNT ion channels represent a robust and versatile biomimetic scaffold for studying fundamentals of transport in biological channels, artificial cell design, and stochastic sensing.

2118-Pos Board B848
High Generation Dendrimers via Thiol-Michael Click Chemistry
Stephen Frayne, Brian Northrop.
Wesleyan University, Middletown, CT, USA.
Polymeric systems have been purposed for drug delivery, tissue engineering and bioimaging by the medical community due to a host of properties and functions that may be designed into their structure. The most recently recognized members of the polymer family, dendrimers, are garnering significant attention due to a numerous of advantageous properties: monodispersity, multivalency, globular architecture and well-defined molecular weight. Unfortunately, the more widespread use of dendrimers is hindered by tedious multi-step syntheses that are plagued by inefficient conversions and difficult purifications. Herein, dendrimers up to the 4th-5th generation will be prepared through a quantitative, irreversible 'click' reaction between maleimides and thiols, and a thermodynamically driven reversible reaction between maleimides and furan. Specifically, branched monomers containing a thiol moiety and furan-protected maleimides on their periphery will be prepared. Then, dendrimer growth steps will be carried out under base-catalyzed 'click' conditions while subsequent deprotection and activation of maleimide groups will be accomplished through heating. Exploiting the orthogonality of the aforementioned reactions enables the design of new classes of highly efficient dendrimers with monodisperse growth. In addition, computational studies of a variety of thiols, Michael acceptors, bases, and solvents will be conducted in order to better understand the relative kinetics and energetics of the thiol-Micahel reaction.

2119-Pos Board B849
Production of Submicron PDMS Particles by Emulsification of Two Phases
Yo Han Choi, Ki-Bong Song.
Electronics and Telecommunications Research Institute, Daejeon, Republic of Korea.
We describe the fabrication of PDMS (poly(dimethylsiloxane)) particles through the emulsion formation of two immiscible phases. Base-catalyzed hydrolysis and polymerization of DMDES (dimethyldiethoxysilane) was previously reported to produce PDMS particles. Spinning of PDMS prepolymer within water and subsequent filtration was also used to make PDMS particles for deformation study. Here, we generated strong hydrodynamic shear force to mix two phases compulsorily.
PDMS was mixed with equal or larger volume of distilled water. These two immiscible liquid were mixed by two methods. Firstly, the mixture was votexed for several tens of minutes. Otherwise, the mixture was emulsified by use of luer-lock syringes connected through a needle. Water was removed after solidification of PDMS. The diamter of PDMS particles by the first method ranged from several hundred micrometers to several millimeters. The size of PDMS particles obtained by the second method was also heterogeneous. By the way, after simple sedimentation of the mixed particles from the second method, we found that PDMS particles with homogeneous diameters were obtained. PDMS particles with diameter about 1 μm or less could be easily produced. Several parameters such as the ratio of components, mixing force, addition of PDMS diluent affected the diameter and size distribution.

2120-Pos Board B850
Soft State Porous Junctions Based Microfluidic Membrane Reactor
Jixiao Liu[1,2], Luke P. Lee[3,4].
[1]Bioengineering, UC Berkeley, Berkeley, CA, USA, [2]Department of Fluid Control and Automation, Harbin Institute of Technology, Harbin, China, [3]Bioengineering, EECS and Biophysics Program, UC Berkeley, Berkeley, CA, USA, [4]Berkeley Sensor and Actuator Center, Berkeley, CA, USA.
Rapid gas-liquid reactions are important for both fundamental sciences and large-scale energy and medical applications. Currently, the limitation of mass-transport through a stable gas-liquid interface hinders the enhancement of reaction efficiency, which cannot be well solved by existing technologies, such as segmented flow or annular flow methods. Here we describe a soft-state porous junction-based microfluidic membrane reactor that utilizes the porous barriers to actively impose gas transport through the reaction channel that is filled with the liquid reactant. Two channel systems next to the reaction channel are separately connected with gas phase reactant of different concentrations, and the concentration difference between the two gas channels lead a diffusion gradient across the reaction channel. Numerical calculation and experimental studies are carried out to characterize the phenomenon during the active gas-liquid reaction by varying both design parameters and reaction factors. The soft-state porous junction works as a selective barrier between the gas and liquid phases that could keep the gas-liquid interface stable and controllable along the reaction channels without allowing liquid trespassing into the gas channels. The rapid gas-liquid reaction could be achieved by tuning the gas concentration differences in the two gas channels due the enhanced air transport through the gas-liquid interface. The proposed microfluidic reactor provides a controllable and stable gas-liquid interface for hydrogen production, synthesis of nanocrystals, advanced biomaterials, diagnostic applications, continuous cell culture, drug screening, and organ functions on chip.